

S E R I E S 2 0 W E L D H E A D



USER'S MANUAL

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# **The Swagelok Limited Lifetime Warranty**

Swagelok hereby warrants to the purchaser of this Product that the non-electrical components of the Product shall be free from defects in material and workmanship for the life of the Product. All electrical components installed in or on the Product are warranted to be free from defects in material and workmanship for twelve months from the date of purchase.

The purchaser's remedies shall be limited to replacement and installation of any parts that fail through a defect in material or workmanship.

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## S E R I E S 2 0 W E L D H E A D

### Weld Head

The Series 20 SWS weld head delivers consistent, precise welds for outside diameters from 1/2 to 2 in. (12 to 52 mm).

A DC motor in the weld head drives a rotor, which carries the tungsten electrode around the weld joint. Optical circuitry in the weld head sends precise feedback to the power supply to control the speed of the rotor.

All moving parts in the weld head are mounted in low-friction devices to provide smooth, consistent operation.

A spring-loaded, floating brush continuously contacts approximately one-third of the circumference of the rotor. This configuration ensures consistent, uniform electrical conductance to the rotor and electrode.

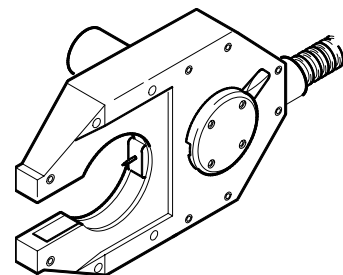


Figure 1 Series 20 Weld Head

### Fixture Block

The Series 20 SWS fixture block accurately aligns and holds tubing, fittings, and valve bodies. The modular design allows you to select different side plates and create the configuration needed for the job.

The fixture block is separate from the weld head, allowing work pieces to be easily aligned and fixtured before welding. Using multiple fixture blocks can increase productivity.

Each fixture block is designed to accommodate a range of work piece sizes. A unique and patented Universal Collet Insert (UCI) fits into the fixture block to match the diameter of the work piece. The collet design firmly holds tubing and fittings that vary  $\pm 0.005$  in. (0,13 mm) from nominal outside diameter. Collets are also available for thin wall pipe. The collets exchange quickly, making the fixture block very adaptable to changing work requirements.

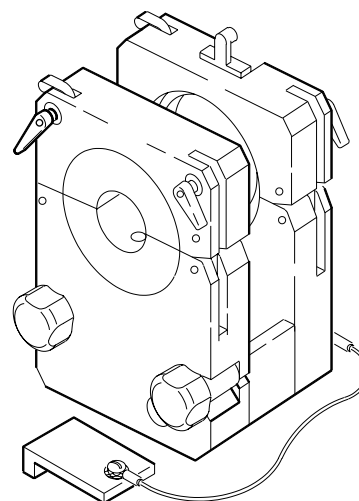


Figure 2 Series 20 Fixture Block

## Unpacking the Weld Head Components

The following weld head components are packaged in a foam-lined shipping container:

- weld head
  - arc gap gage
  - electrode package
  - tool package
1. Inspect the container for damage.
  2. Remove the components from the container.
  3. Check the items for any damage.
  4. Verify that the weld head serial number matches the serial number on the shipping container.
  5. Record the model and serial numbers, and the delivery dates on page 7 of the *Regulatory* Module.

## Installing the Weld Head

The weld head has four connectors that plug into the power supply. See Figure 3.

The four connectors on the cable are:

- fixture
- electrode (red)
- work (green)
- weld head shielding gas

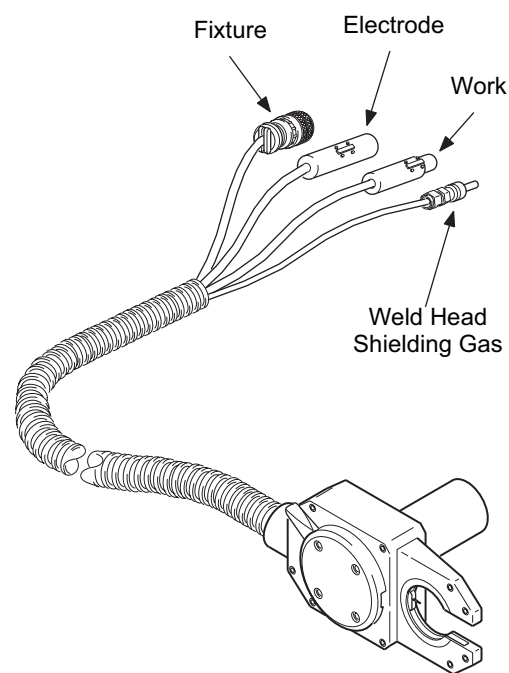


Figure 3 Weld Head

Connect the four connectors to the rear panel of the power supply by performing the following steps (see Figure 4):

1. Locate the weld head.
2. Align the notch on the multi-pin connector with the small tab in the mating socket on the rear panel labeled **FIXTURE**. Insert the connector in the socket. Turn the connector sleeve clockwise by hand until it is tight. This connection provides the control signals to drive the weld head.
3. Insert and fully seat the red connector into the socket on the rear panel labeled **ELECTRODE**. Twist the connector 1/4-turn clockwise to lock it into place. This connection is the negative (-) terminal of the weld head.
4. Insert the green connector into the socket on the rear panel labeled **WORK**. Twist the connector 1/4-turn clockwise to lock it into place. This connection is the positive (+) terminal of the weld head.
5. Insert the weld head shielding gas connector into the Swagelok Quick-Connect stem labeled **TO WELD HEAD**. Ensure that the connector is firmly attached. This connection provides shielding gas to the weld head through a solenoid valve in the power supply.

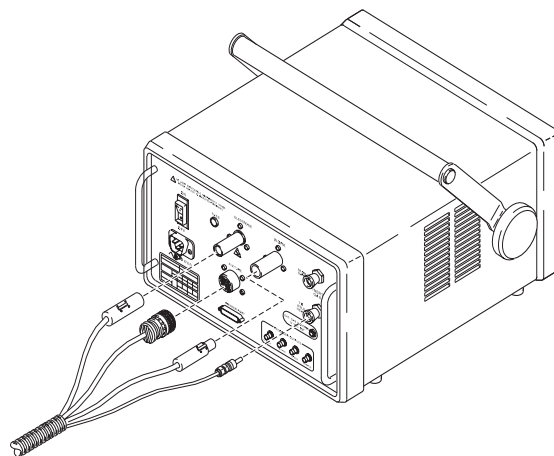


Figure 4 Weld Head Connectors



### Caution!

**Ensure that the fixture connector is fully seated in the mating socket and the threaded sleeve is tight.**

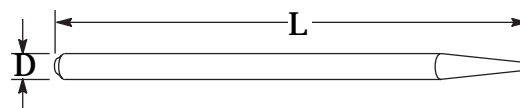
**Note:** The weld head shielding gas connector must be a single-end shut-off (SESO) Swagelok Quick-Connect stem (SS-QC4-S-400).

## Installing the Electrode in the Weld Head

This Swagelok weld head comes with a selection of electrodes. The following instructions show how to properly install an electrode in the weld head.

### Selecting the Proper Electrode

Electrode length and diameter depend on your weld head model and the outside diameter of the work piece being welded. To select the correct electrode use the Electrode Selection Table.



*Table 1 Electrode Selection Table*

Electrode Part No.	Component OD	Pipe	Electrode Length (L)	Electrode Diameter (D)
CWS-C.062-1.630-P	1/2 in.	1/4	1.630 in.	0.062 in.
	3/4 in.	1/2	(41,40 mm)	(1,57 mm)
	12 mm	3/8		
	18 mm			
	22 mm			
CWS-C.062-1.380-P	1 in.	3/4	1.380 in.	0.062 in.
	1 1/4 in.	1	(35,05 mm)	(1, 57 mm)
	23 mm			
	25 mm			
	28 mm			
CWS-C.062-1.105-P	35 mm		1.105 in.	0.062 in.
			(28,07 mm)	(1,57 mm)
CWS-C.062-.855-P	1 1/2 in.	1 1/4	0.855 in.	0.062 in.
	2 in.	1 1/2	(21,72 mm)	(1,57 mm)
	35 mm			
	40 mm			
	52 mm			

## Electrode Geometry

This illustration shows the electrode shape Swagelok suggests. Properly ground electrodes provide consistent, repeatable welds. Pre-ground electrodes are available from your Swagelok representative. See your parts list for ordering information.

The electrode part numbers are assigned as follows:

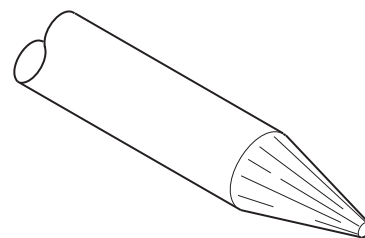
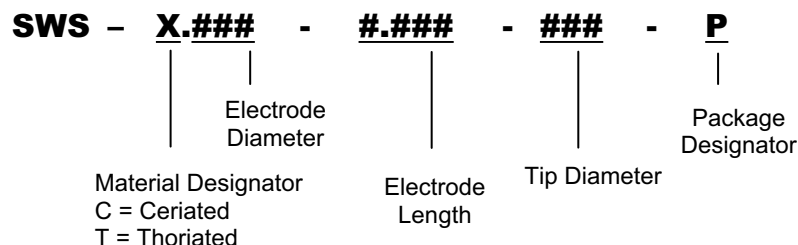
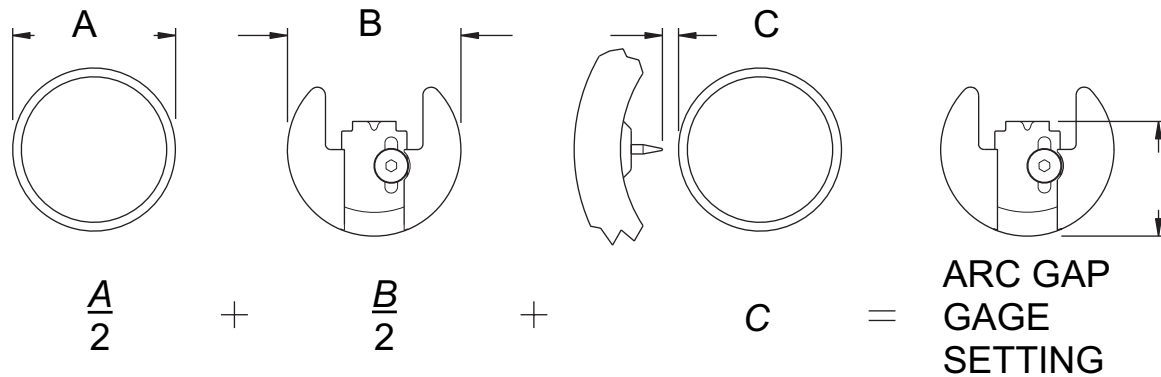


Figure 5 Tungsten Electrode

The ceriated electrode material type is a mixture of 98 % tungsten and 2 % cerium and is commonly referred to as “2 % ceriated.” This electrode type has demonstrated improved arc starting performance over the 2 % thoriated type, particularly when using purified shielding gas.

## Calculating Arc Gap Gage Settings

To determine the arc gap gage setting for a specific arc gap, use the formula below.



### Where

A = largest OD on the weld end of the tubing or fitting (welding diameter).

B = Arc gap gage diameter

C = desired arc gap

Figure 6 Arc Gap Gage Setting Formula

### Example No. 1: (Series 20 Weld Head)

1 to 1 in. tube butt weld - largest outside diameter      A = 1.000 in.

Arc gap gage diameter      B = 3.118 in.

Desired arc gap      C = 0.025 in.

$$\frac{1.000 \text{ in.}}{2} + \frac{3.118 \text{ in.}}{2} + 0.025 \text{ in.} = 2.084 \text{ in.}$$

### Example No. 2: (Series 20 Weld Head)

25 to 25 mm tube butt weld - largest outside diameter      A = 25,00 mm

Arc gap gage diameter      B = 79,20 mm

Desired arc gap      C = 0,50 mm

$$\frac{25,00 \text{ mm}}{2} + \frac{79,20 \text{ mm}}{2} + 0,50 \text{ mm} = 52,60 \text{ mm}$$



## Setting the Arc Gap

The proper arc gap setting facilitates control of the weld and improves consistency. The following steps cover how to set the arc gap.

The arc gap is set by using the arc gap gage provided with the weld head. The gage is adjusted for the desired arc gap and then installed in the rotor. With the gage in place, the electrode can be positioned with reasonable accuracy.

### Setting the Arc Gap Gage

1. Measure the outside diameters of the work pieces being welded using a caliper or micrometer. See Figure 7(A). The M100 will calculate the arc gap gage setting automatically when using the Auto Entry feature.
2. Refer to the table for your nominal OD. Find the “actual” outside diameter nearest to your measurement.

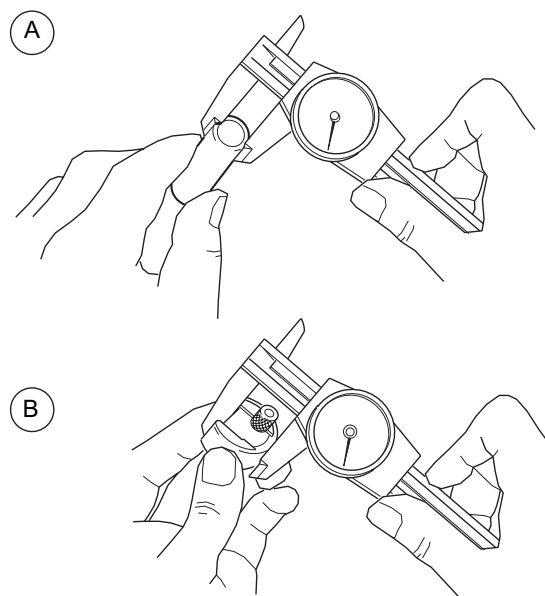


Figure 7 Setting an Arc Gap gage

Table 2 SWS-20H-C Arc Gap Gage Dia. 3.118 in.

Nominal OD (in.)	Actual OD (in.)	Setting for 0.030 in. Arc Gap (in.)	Setting for 0.040 in. Arc Gap (in.)	Setting for 0.050 in. Arc Gap (in.)	Setting for 0.060 in. Arc Gap (in.)	Setting for 0.070 in. Arc Gap (in.)	Setting for 0,5 mm Arc Gap (mm)	Setting for 0,64 mm Arc Gap (mm)	Setting for 0,76 mm Arc Gap (mm)	Setting for 1,02 mm Arc Gap (mm)	Setting for 1,14 mm Arc Gap (mm)
1/2	.500	1.839	1.849	1.859	1.869	1.879	46,45	46,59	46,97	46,97	47,09
3/4	.750	1.964	1.974	1.984	1.994	2.004	49,63	49,77	49,89	50,15	50,27
1	1.000	2.089	2.099	2.109	2.119	2.129	52,80	52,94	53,06	53,32	53,44
1 1/4	1.250	2.214	2.224	2.234	2.244	2.254	55,98	56,12	56,24	56,50	56,62
1 1/2	1.500	2.339	2.349	2.359	2.369	2.379	59,15	59,29	59,41	59,67	59,79
2	2.000	2.589	2.599	2.609	2.619	2.629	65,50	65,64	65,76	66,02	66,14

Table 3 SWS-20H-C Arc Gap Gage Dia. 79,20 mm.

Nominal OD (mm)	Actual OD (mm)	Setting for 0,50 mm Arc Gap (mm)	Setting for 0,64 mm Arc Gap (mm)	Setting for 0,76 mm Arc Gap (mm)	Setting for 1,02 mm Arc Gap (mm)	Setting for 1,14 mm Arc Gap (mm)
12	12,00	46,12	46,26	46,38	46,64	46,76
18	18,00	49,12	49,26	49,38	49,64	49,76
22	22,00	51,12	51,26	51,38	51,64	51,76
23	23,00	51,62	51,76	51,38	51,64	51,76
25	25,00	52,62	52,76	52,88	53,14	53,26
28	28,00	54,12	54,26	54,38	54,64	54,76
35	35,00	57,62	57,76	57,88	58,14	58,26
52	52,00	66,12	66,26	66,38	66,64	66,76

Table 4 SWS-20H-C Pipe Arc Gap Gage Settings (standard)

Pipe Size (in.)	Actual OD (in.)	Setting for 0.030 in. Arc Gap	Setting for 0.040 in. Arc Gap	Setting for 0.050 in. Arc Gap	Setting for 0.060 in. Arc Gap	Setting for 0.070 in. Arc Gap
1/4	0.54	1.859	1.869	1.879	1.889	1.899
3/8	0.675	1.927	1.937	1.947	1.957	1.967
1/2	0.84	2.009	2.019	2.029	2.039	2.049
3/4	1.05	2.114	2.124	2.134	2.144	2.154
1	1.315	2.247	2.257	2.267	2.277	2.287
1 1/4	1.66	2.419	2.429	2.439	2.449	2.459
1 1/2	1.9	2.539	2.549	2.559	2.569	2.579

Table 5 SWS-20H-C Pipe Arc Gap Gage Settings (metric)

Pipe Size (mm.)	Actual OD (mm.)	Setting for 0,76 mm. Arc Gap	Setting for 1,02 mm. Arc Gap	Setting for 1,27 mm. Arc Gap	Setting for 1,52 mm. Arc Gap	Setting for 1,78 mm. Arc Gap
10,2	10,2	45,46	45,72	45,97	46,22	46,48
13,5	13,5	47,11	1,937	1,947	1,957	1,967
17,2	17,2	48,96	49,22	49,47	49,72	49,98
18,9	18,9	49,81	50,07	50,32	50,57	50,83
21,3	21,3	51,01	51,27	51,52	51,77	52,03
26,9	26,9	53,81	54,07	54,32	54,57	54,83
33,7	33,7	57,21	57,47	57,72	57,97	58,23
42,4	42,4	61,56	61,82	62,07	62,32	62,58
48,3	48,3	64,51	64,77	65,02	65,27	65,53

## Inserting the Electrode into a Rotor

1. Without the fixture block attached, press **WELD** on the operator panel.
2. Use **JOG** to position the rotor as shown in Figure 8.
3. Loosen the two electrode clamping screws. If you are replacing the electrode, remove the electrode.
4. Insert the new electrode, with the sharp tip pointing out. Tighten the electrode clamping screws slightly to hold it in place temporarily.
5. Set the proper arc gap with the arc gap gage.

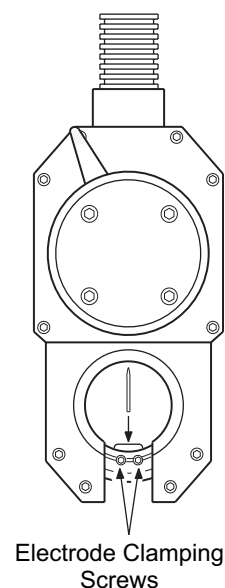


Figure 8 Electrode Installation



### **WARNING!**

**DO NOT PRESS START WHILE TOUCHING THE ELECTRODE.**



### **Caution!**

**Do not jog or move the rotor unless the electrode is clamped in place.**

## Setting the Arc Gap

1. Use **JOG** to position the rotor as shown.  
This allows access to the electrode clamping screws.
2. Insert the arc gap gage into the rotor. See Figure 9(A).
3. Tilt the weld head upward. Loosen the electrode screw allowing the electrode to drop onto the gage surface. See Figure 9(B).
4. Tighten the electrode clamping screws just enough to secure the electrode. Remove the arc gap gage.
5. Press **HOME** to return the rotor to the home position.

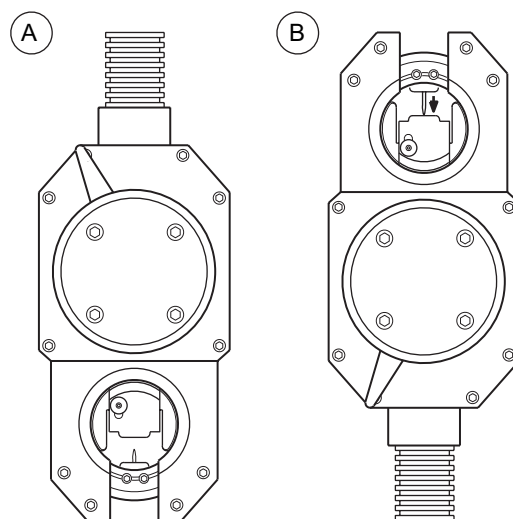


Figure 9 Setting the Arc Gap



### Caution!

Do not jog or move the rotor unless the electrode is clamped in place.

## Preparing the Work

It is important to prepare the tube pieces properly before welding. Refer to Figure 10.

Tubing must be square and burr-free to ensure repeatable, high-quality autogenous fusion welds. Cut the tubing to length with a hacksaw or tube cutter. Face the tube ends with a lathe or a portable facing tool. Deburr the ends, making sure that both the inside and outside diameters are square and burr-free. Clean the tube ends using an appropriate solvent.

Minimize the chance of a poor quality weld by following these guidelines:

- Tube ends must be square.
- Tube ends must not have a wall thickness variation exceeding  $\pm 15\%$  of nominal.
- Tube ends must be burr-free.
- Tube ends must be free of any rust, grease, oil, paint, or other surface contaminants.

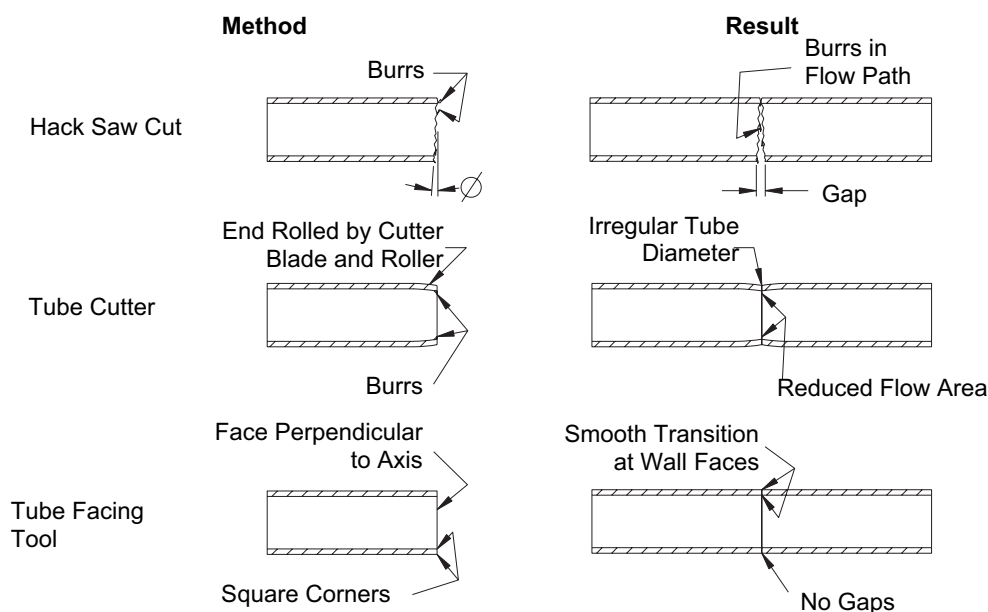


Figure 10 Tube Preparation

## Fixturing the Work

Select or configure the appropriate fixture block. Select the collets to match the work outside diameter.

### Selecting the Fixture Block and Collets

1. Select the fixture block that accepts the outside diameter of the tube to be welded. Refer to Table 6.

*Table 6 Fixture Blocks*

Model	OD Capacity	Minimum Weld Extension Length
SWS-20TFB-A	1/2 to 2 in. (12 to 52 mm)	1.45 in. (36,83 mm)
SWS-20FSP1L or SWS-20FSP1R	1/2 to 2 in. (12 to 52 mm)	0.80 in. (20,32 mm)

2. Select the proper collets for the diameter of the parts being welded. Refer to Table 7.

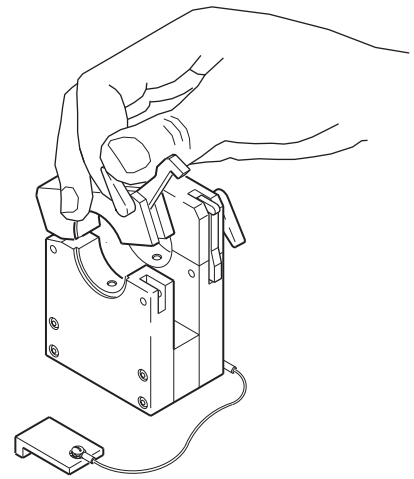
*Table 7 Collets*

Model	OD Capacity	Comments
CWS-20UCI- <u>X</u> ®	1/2 in. to 2 in. (12 mm to 48.3 mm)	Tubing/ tube fittings
CWS-20UCI- <u>XP</u> ®	1/4 to 1 1/2	Pipe Add J suffix for JIS pipe (- <u>XPJ</u> )®  Add MMP suffix for metric pipe (- <u>XMMP</u> )®
SWS-20UCI- <u>XTN</u> ®	1/2 in. to 2 in. (12 mm to 52 mm)	Tubular weld fitting collet for SWS-20FSP1L and SWS-20FSP1R Add MM ( <u>XMMTN</u> )® suffix for metric sizes
SWS-20UCI-MC	N/A	Collet to hold ferrule mandrels for SWS-20TFB-A fixture block

® Where X identifies the collet size in 1/16ths or metric (MM suffix)

## Installing the Collets in a Tube Fixture Block

1. Release both levers and open the tube fixture block.  
See Figure 11.



*Figure 11 Opening the Fixture Block*

2. Install the collet halves in both the top and bottom side plates and tighten the collet screws. Make sure the collet shoulder is flush against the fixture side plate. See Figure 12.

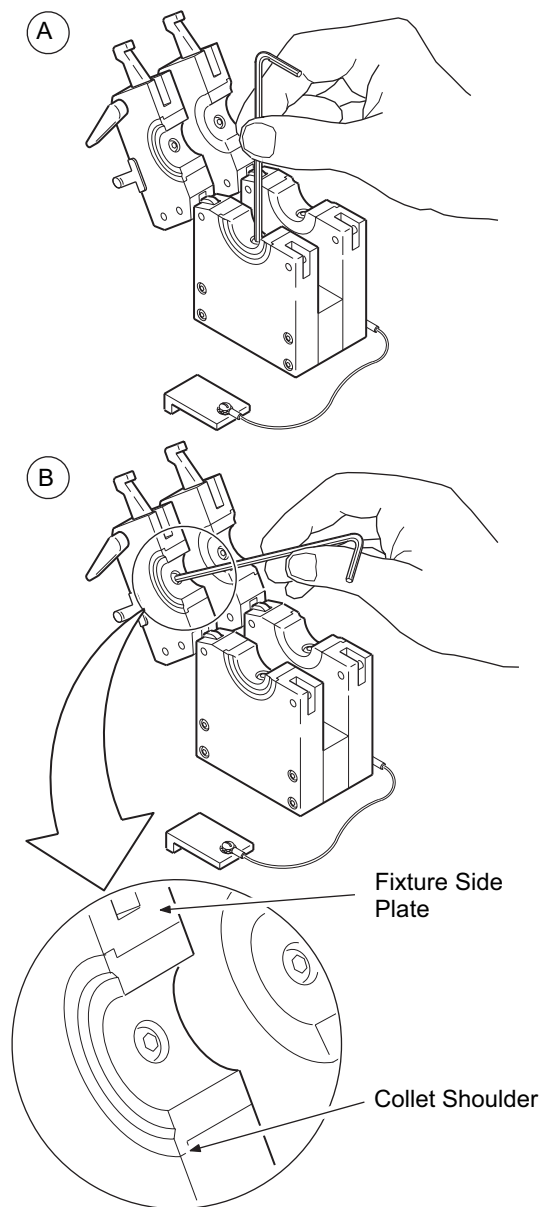


Figure 12 Installing Collets



## Aligning the Work Pieces in the Tube Fixture Block

1. Place the centering gage in one side of the tube fixture block. The centering gage must span the width of the collet. Verify that the centering gage is positioned correctly for either the thick or thin side plate. See Figure 13.
2. Butt one work piece against the centering gage. See Figure 14(A).
3. Lock down the top side plate. See Figure 14(B).
4. Remove the centering gage.

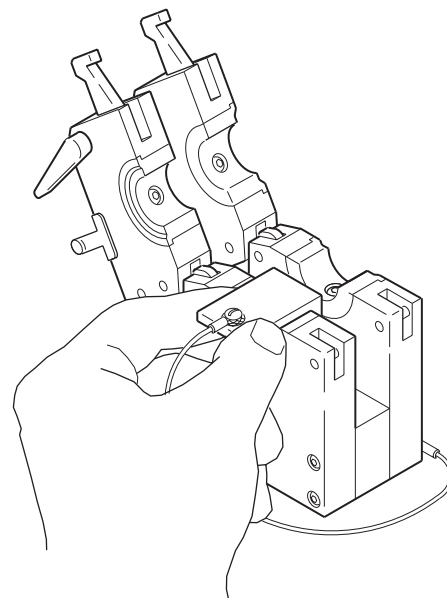


Figure 13 Place the Centering Gage

**Note:** When welding a Swagelok ATW fitting to tubing, butt the tubing against the centering gage first.

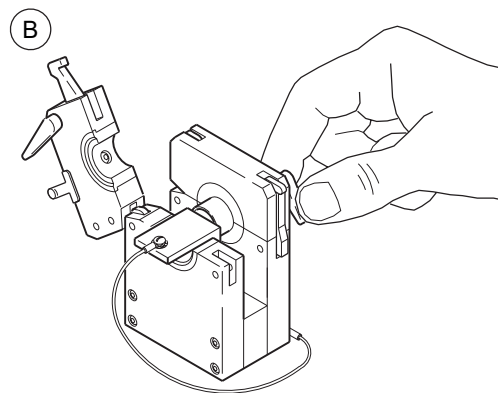
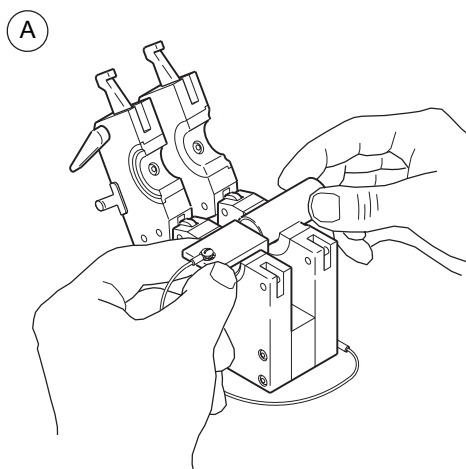
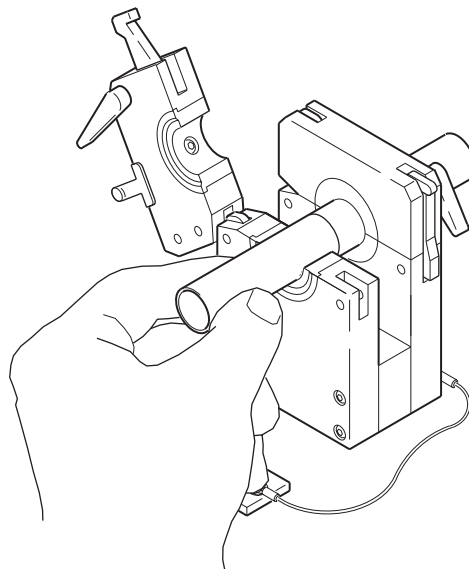


Figure 14 Placing First Work Piece in the Fixture Block

5. Butt the second work piece against the first work piece, and lock down the top side plate. See Figure 15.
6. Inspect 360° around the weld joint for fit and alignment. If the alignment is not correct proceed to the next section for alignment adjustment instructions.



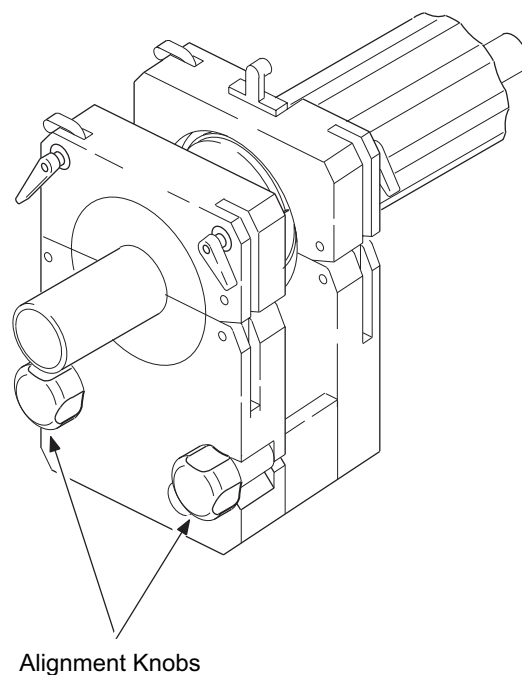
*Figure 15 Placing Second Work Piece*

## Adjusting the Fixture Block

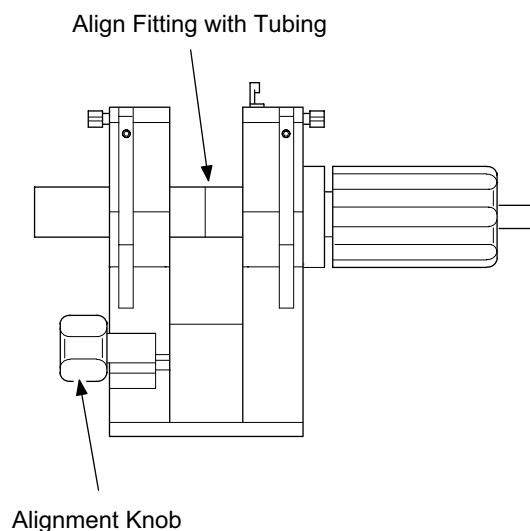
The modular design of the Series 20 Fixture Block allows you to assemble the block to meet a variety of welding requirements.

To align tubing in the SWS-20TFB-A Fixture Block follow these steps:

1. Loosen the alignment knobs. See Figure 16.
2. Align the tubing with the fitting. See Figure 17.
3. Tighten the alignment knobs.



*Figure 16 Loosen the Alignment Knobs*



*Figure 17 Aligning the Tubing*

## Mating the Weld Head to the Fixture Block

1. Rotate the locking lever on the weld head counter-clockwise until it stops. See Figure 18.
2. Insert the weld head into the fixture block. See Figure 19(A).
3. Rotate the locking lever clockwise to secure the weld head. See Figure 19(B).

## Operating the Weld Head

Operate the weld head using the following parameters:

<b>Shield Gas Flow Rate std ft<sup>3</sup>/hr (std L/min)</b>	20 to 40 <sup>①</sup> (9,4 to 18,8)
<b>Prepurge and Postpurge Minimum Time in Seconds</b>	30 <sup>②</sup>
<b>Start Power</b>	Normal
<b>Maximum Recommended Average Amps</b>	70 Amps at 50% Duty Cycle

- ① Set flow to higher rates when welding at high currents.
- ② Flow should be continuous for cooling when welding at high currents.

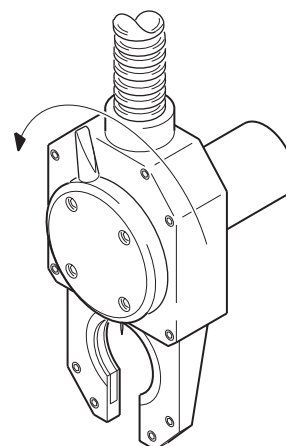


Figure 18 Releasing the Locking Lever

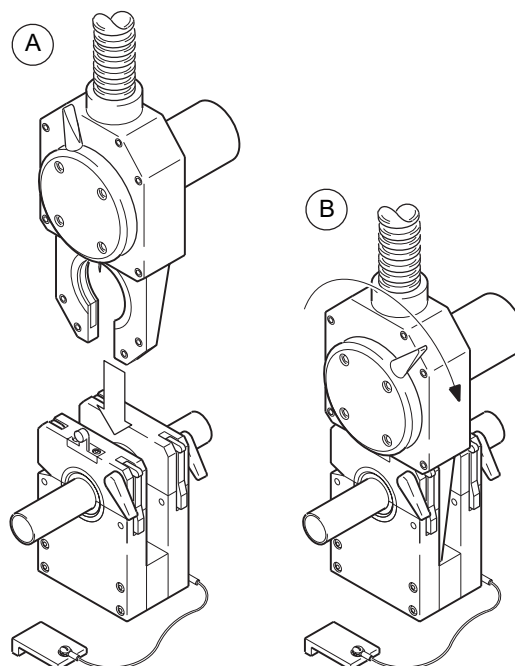


Figure 19 Mating the Weld Head to the Fixture Block

## Maintenance

To ensure your Swagelok Welding System (SWS) equipment is always in proper working order, you must perform periodic maintenance on the system components.

This section describes the procedures necessary for maintaining the fixture blocks and weld heads.

For detailed part drawings and information, refer to the Parts Drawings section at the end of this manual.

Perform fixture block maintenance daily and after every 40 hours of welding time. Depending on usage and wear, maintenance may be performed before the 40-hour interval.

**Note:**

*If you experience problems while performing the procedures in this section, refer to the Troubleshooting manual or contact your Swagelok representative.*

## Fixture Block Daily Maintenance

At the start of each work day:

1. Inspect the fixture block for cleanliness, wear and damage. See Figure 20.
2. Remove dirt, carbon, and vapor deposits from the fixture block with a clean, soft cloth. A solvent such as alcohol or acetone can be used. Remove heavier deposits with a fine-grit abrasive pad.

At the end of each workday, clean and store the fixture block in a dry place.

## Fixture Block Periodic Maintenance

Every 500-700 welds:

1. Inspect and clean the collets. See Figure 20(A).
2. Check for scratches and dents.
3. Remove dirt and oxides from all surfaces of the collet with a soft stainless steel wire brush.
4. Remove any oxides from the non-anodized mating surfaces of the side plates with a fine-grit abrasive pad. See Figure 20(B).
5. Remove any dirt and oxides from the inside surfaces of the side plates with a clean, soft cloth. See Figure 20(C). Remove heavier deposits with a fine-grit abrasive pad.
6. Check the lever cam and latch for smooth operation. See Figure 21.
  - a. Remove lever cam by removing the set screw from the latch and pulling the lever cam from the fixture block.
  - b. Clean the lever cam and lightly lubricate if necessary.
  - c. Replace the set screw and verify that it is locked tightly in position.

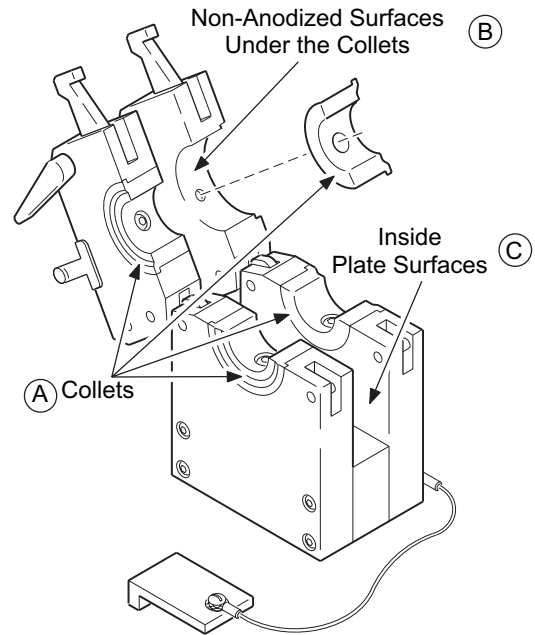


Figure 20 Cleaning the Collets and Collet Mounting Surfaces

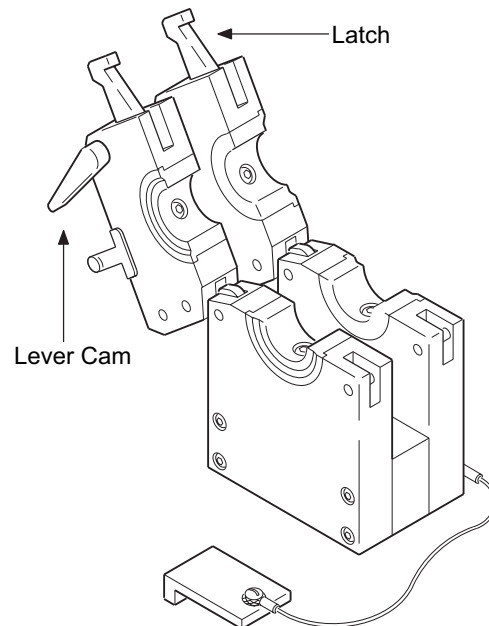


Figure 21 Lever Cam and Latch

## Weld Head Daily Maintenance

Perform weld head maintenance daily and every 500 to 700 welds. Depending on usage and wear, maintenance may be performed before the 500-weld mark.

At the start of each work day:

1. Inspect the weld head for cleanliness. Pay close attention to the rotor area.
2. Press **HOME**. Check the rotor for smooth rotation. If the rotation is erratic or noisy, disassemble the weld head and clean the rotor, gears, and brush. See **Weld Head Disassembly and Cleaning** on page 23.

At the end of each work day:

1. Remove dirt, carbon, and vapor deposits from the weld head with a clean, soft cloth and a solvent such as isopropyl alcohol.
2. Store the weld head in a clean, dry place.

## Weld Head Periodic Maintenance

Every 500 to 700 welds, measure the rotor speed to verify its accuracy.

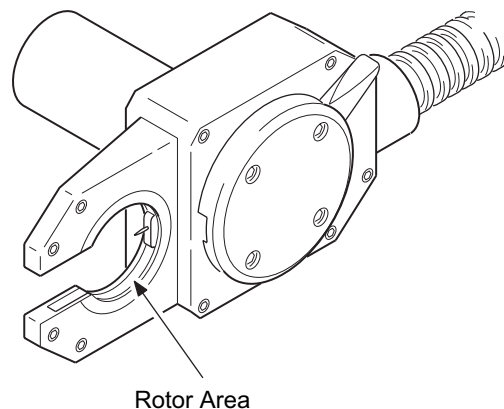
### Creating the Weld Head Timing Check Program

1. Select PROG/CREATE.
2. Select MANUAL ENTRY, then press **ENTER**.
3. Select LEVELS ONLY, then press **ENTER**.
4. Enter 2 levels, then press **ENTER**.
5. Enter the programmer name. Typically it would be your name.
6. Enter the Side 1 Tube Diameter (20), then press **ENTER**.
7. Select 20 from the Weld Head pick list.



### WARNING!

**DISCONNECT THE WELD HEAD FROM THE POWER SUPPLY BEFORE PERFORMING THE ADJUSTMENT OR MAINTENANCE.**



*Figure 22 Inspect Exposed Surfaces of the Weld Head*



### Caution!

**Do not use lubricants inside the weld head.**

8. Using Table 8, enter the following parameters.

*Table 8 Parameters*

Parameter	Entry
Start Power	Normal
Start Current	20
Rotor Delay	0
Prepurge	5
Postpurge	5
Downslope	0

9. Using Table 9, enter the following parameters for level 1 and level 2.

*Table 9 Level 1 and Level 2 Parameters*

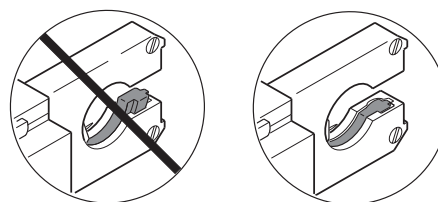
Parameter	Level 1 Setting	Level 2 Setting
Impulse	2.0	2.0
Maintenance	2.0	2.0
Weld Time	30	15
Ramp	0	0
Pulse Rate	1	1
Pulse Width	50	50
Speed Hi	4.00	4.00
Speed Lo	4.00	4.00

10. Press the **WELD** mode key.  
 11. Select SAVE TO MEMORY, then press **ENTER**.  
 12. Enter the procedure name (Timing Test), then press **ENTER**.

### Checking the Weld Head Timing

1. Select WELD/TEST.
2. Press **START**.
3. After verifying the screen displays “WELD HEAD IS CLEAR TO ROTATE”, press **ENTER**.
4. Verify the rotor completes two revolutions then check that no part of the rotor is exposed after it stops.  
See Figure 23.

If the rotor does not complete the revolutions and stop correctly, contact your Swagelok representative.



Wrong

Correct

*Figure 23 Rotor Position*



### WARNING!

**THE ROTOR WILL ROTATE ONE REVOLUTION TO HOME POSITION 15 SECONDS AFTER COMPLETING THE TWO REVOLUTIONS.**



## Weld Head Disassembly and Cleaning

This section describes how to disassemble the weld head and rotor.

### Weld Head

To disassemble the weld head, follow these steps:

1. Blow any loose material from the weld head assembly with clean, low-pressure air.
2. Remove the four screws, locking ring, and locking ring plate. See Figure 24.
3. Remove the work extension screw, lock washer, and the work extension. Inspect the work extension for pitting, wear, or damage. See Figure 25.
4. Replace work extension if necessary. Refer to the **Parts Drawings** at the end of this manual for part ordering information.

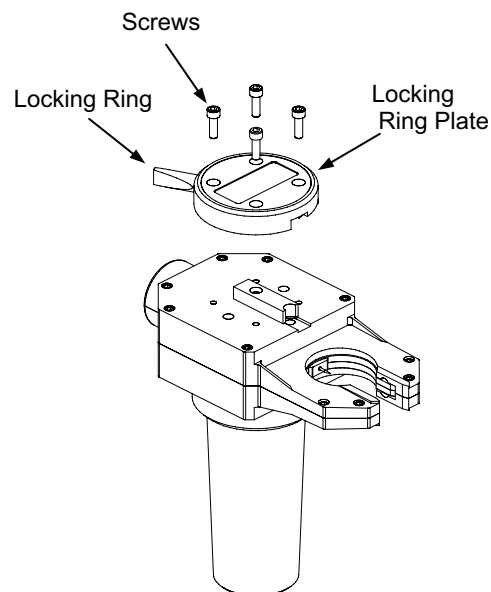


Figure 24 Removing the Locking Ring and Locking Ring Plate

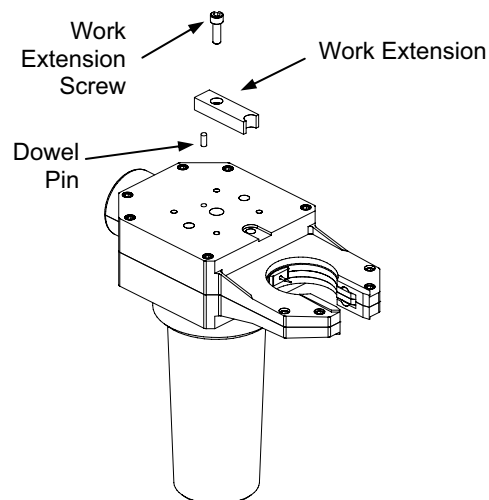
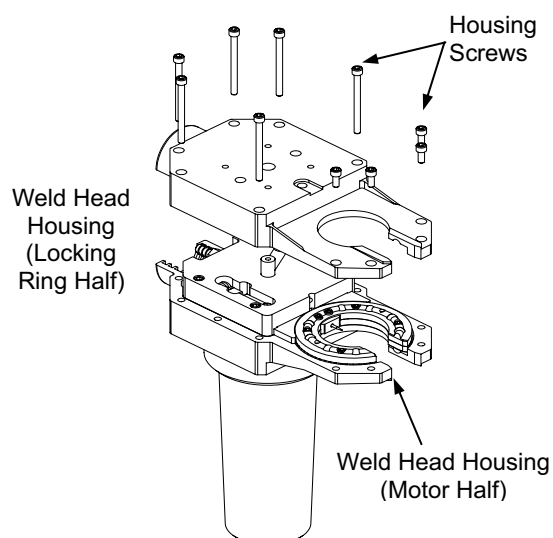
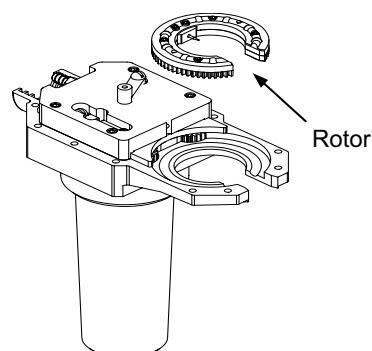


Figure 25 Removing the Work Extension

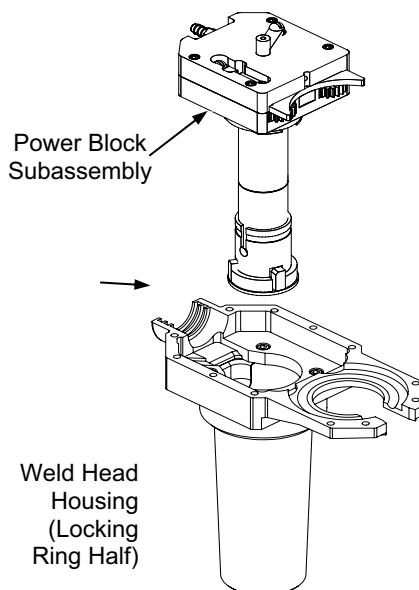
5. Remove the weld head housing screws from the housing. Using a slight rocking motion, carefully separate the locking ring half of the weld head housing from the motor half. See Figure 26.
6. Carefully separate the weld head housing halves so that internal components are not damaged.
7. Remove the rotor from the motor half of the weld head housing. See Figure 27.
8. Carefully lift the power block subassembly out of the motor half of the weld head housing. See Figure 28.



*Figure 26 Removing the Locking Ring Half of the Weld Head Housing*



*Figure 27 Removing the Rotor*



*Figure 28 Removing the Power Block Subassembly*

9. Examine the brush. See Figure 29.

Inspect and clean the brush using the following steps:

- a. Check the brush for excessive wear.
  - b. Verify that the brush has a groove. Replace the brush if the groove is not present. Refer to the **Parts Drawings** at the end of this manual for part ordering information.
  - c. Remove any oxidation from the brush with a fine-grit abrasive pad.
10. Blow any loose material from the power block assembly with clean, low-pressure air.
  11. Verify that the two power strap screws are tight. See Figure 30.
  12. Verify that the work plate screw is tight and free from excessive oxidation. See Figure 31. Clean the work plate with a fine-grit abrasive pad if necessary.
  13. Inspect the gears for wear and replace if damaged. Refer to the **Parts Drawings** at the end of this manual for part ordering information.

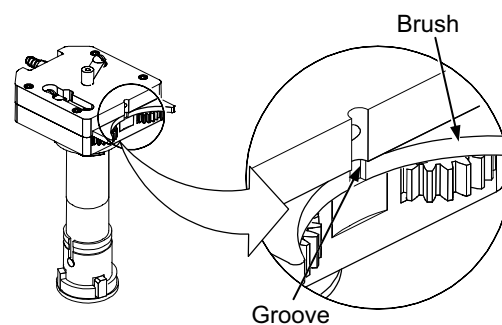


Figure 29 Inspecting the Brush

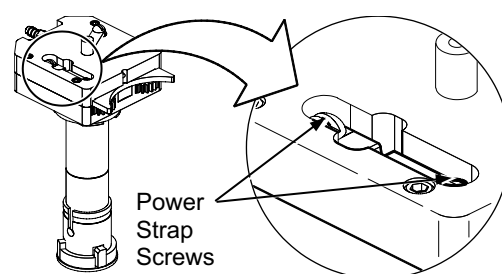


Figure 30 Inspecting the Power Strap Screws

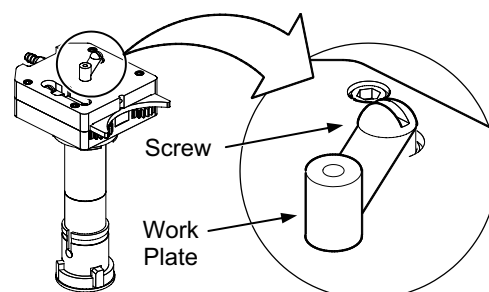
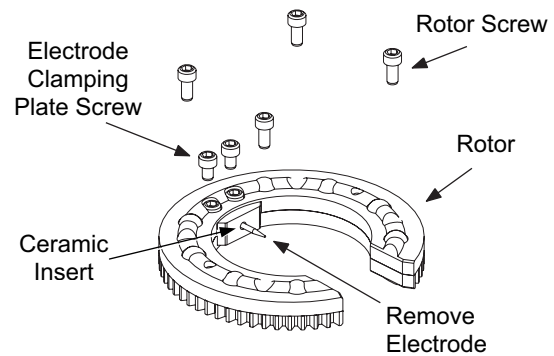


Figure 31 Inspecting the Work Plate and Screws

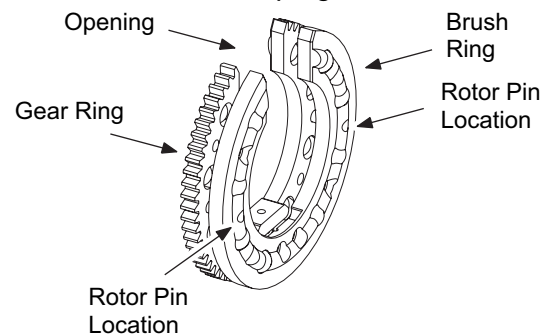
## Rotor

To disassemble the rotor, follow these steps:

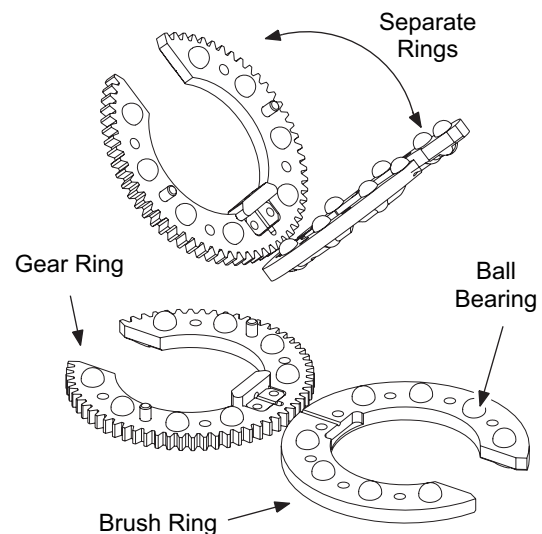
1. Remove the rotor screws and the electrode clamping plate screws from the rotor. Remove the electrode from the ceramic insert. See Figure 32.
2. Place the rotor on a clean, dry surface with the rotor opening facing up. Separate the gear ring from the brush ring. See Figure 33.
3. Completely separate the gear ring from the brush ring as shown in Figure 34. Lay the rings flat on the work surface.
4. Remove the ball bearings from the gear and brush rings.
5. Inspect the ball bearings for wear and damage. Replace if necessary.
6. If the ball bearings are dirty, clean them with isopropyl alcohol or cleaning solution. Dry the balls thoroughly.



*Figure 32 Removing the Rotor and Electrode Clamping Plate Screws*



*Figure 33 Placing the Rotor on the Work Surface*



*Figure 34 Separating the Gear Ring from the Brush Ring*

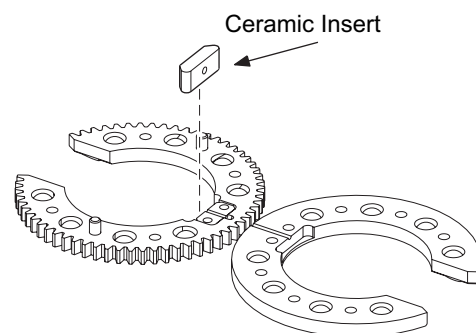
7. Remove the ceramic insert. See Figure 35.
8. Inspect the ceramic insert. If it has carbon or other deposits, clean it with a fine-grit abrasive pad or soft nylon brush.
9. Remove the electrode clamping plate. Clean it with a fine-grit abrasive pad. See Figure 36.
10. Inspect the brush and gear rings for dirt or other deposits. Clean the rings with a fine-grit abrasive pad or soft stainless steel wire brush.
11. Dry all parts with clean, low-pressure air before reassembly.

## Weld Head Assembly

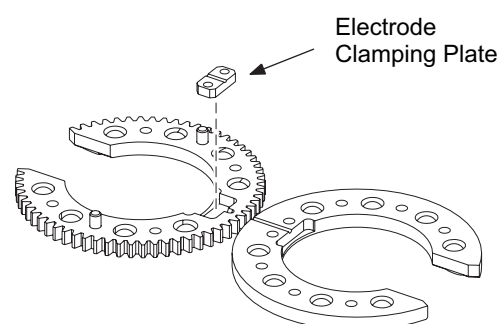
Assembly of the weld head and rotor is the reverse of the disassembly procedures.

To assemble the weld head, follow these steps:

1. Complete the steps in reverse order in **Rotor** on page 26.
2. Complete the steps in reverse order in **Weld Head Disassembly and Cleaning** on page 23.



*Figure 35 Removing the Ceramic Insert*



*Figure 36 Removing the Electrode Clamping Plate*



### Caution!

**Do not pinch any internal wiring during reassembly.**



## Parts Drawings

This section includes exploded assembly drawings and associated parts lists. These drawings are provided as a guide to identifying part names. For specific part ordering information, contact your Swagelok representative.

The parts identified in this section include:

- SWS-20H-C Weld Head
- SWS-20H-C Motor and Power Block Assembly
- SWS-20H-C Rotor Assembly
- SWS-20TFB-A Tube Fixture Block
- SWS-20FSP1R Special Purpose Side Plate
- SWS-20FSP1L Special Purpose Side Plate

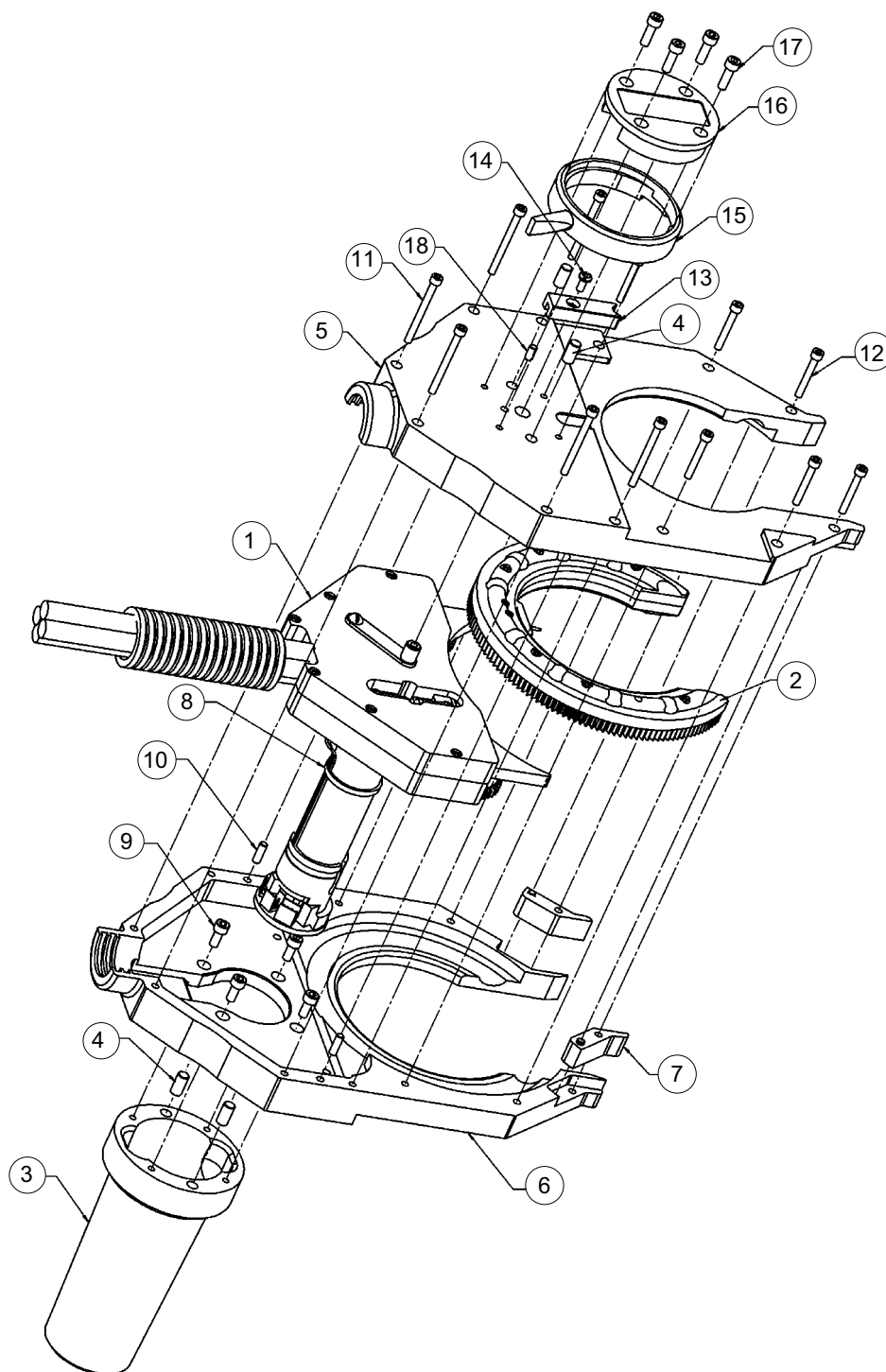


Figure 37 SWS-20H-C Weld Head



Table 10 SWS-20H-C Weld Head Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	See Power Block Assembly Drawing	N/A	N/A
2	Rotor Assembly	21210	1
3	Motor Cover	11121	1
4	SS Dowel Pin, 0.187 x 0.375 in.	13138	10
5	Housing (Work Side)	20995	1
6	Housing (Motor Side)	21204	1
7	Bearing Pad	21075	1
8	Motor Assembly	N/A	N/A
9	SS Socket Head Cap Screw, 6-32 x 0.312 in.	13254	10
10	SS Dowel Pin, 0.125 x 0.375 in.	13135	10
11	SS Socket Head Cap Screw, 4-40 x 1.250 in.	13162	10
12	SS Socket Head Cap Screw, 4-40 x 0.812 in.	13161	10
13	Work Extension Bar	21054	1
14	Brass Button Head Screw, 4-40 x 0.250 in. w/ nylon	21066	10
15	Locking Ring	21065	1
16	Locking Ring Plate	11104-A	1
17	Plastic Socket Head Cap Screw, 6-32 x 0.437 in.	13105	10
18	SS Dowel Pin, 0.125 x 0.250 in.	13134	10

For part ordering information, contact your Swagelok representative.

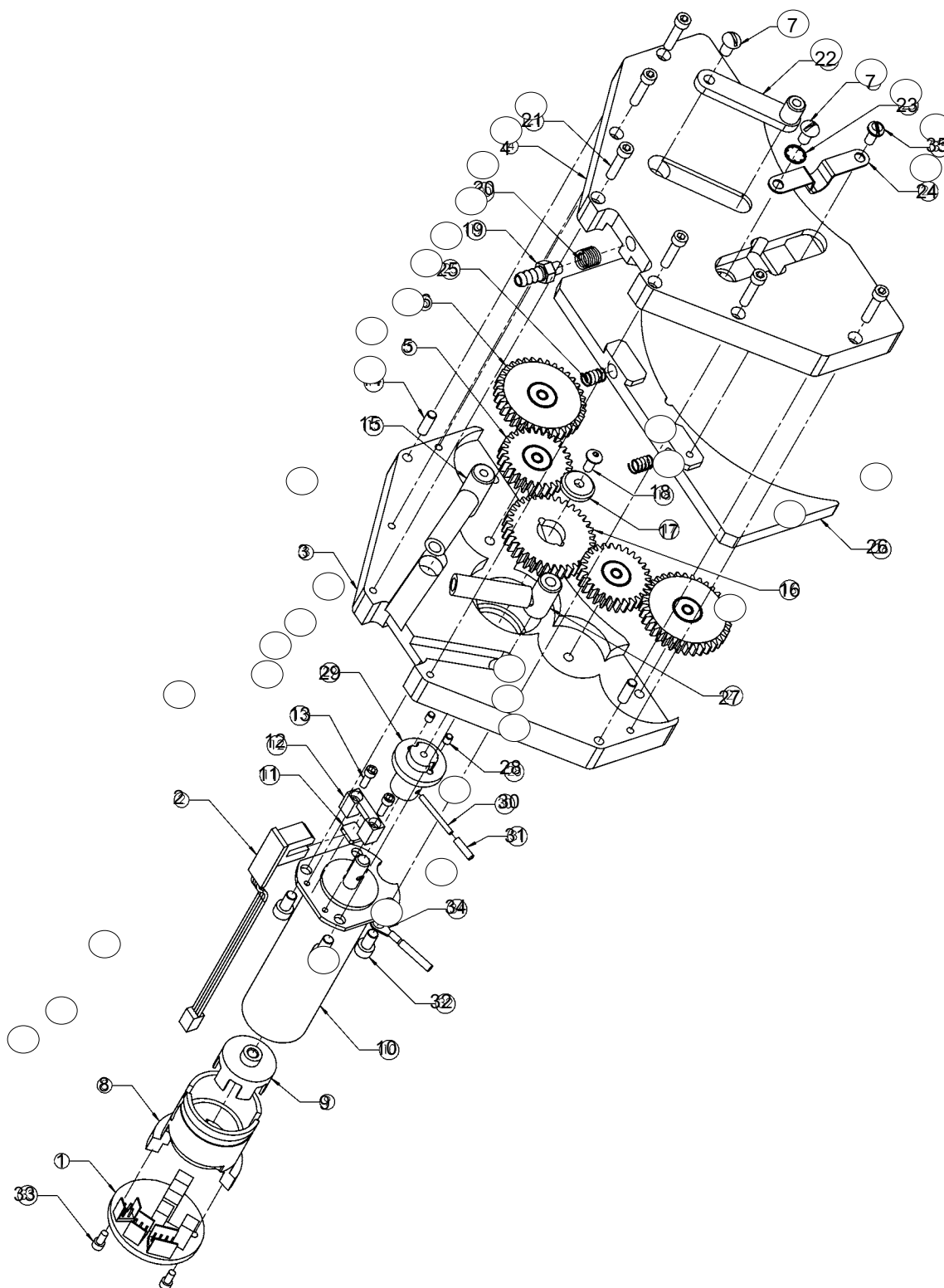


Figure 38 SWS-20H-C Motor and Power Block Assembly

Table 11 SWS-20H-C Motor and Power Block Assembly Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	Encoder Circuit Board	10708	1
2	Home Sensor	10709	1
3	Power Block (Motor Side)	21067	1
4	Power Block (Work Side)	21069	1
5	Gear Assembly	10009-5	1
6	Gear Assembly	10009-6	1
7	Brass Round Head Screw, 6-32 x 0.250 in.	13124	10
8	Sleeve Sensor Mount	N/A	N/A
9	Encoder Wheel	N/A	N/A
10	Motor	N/A	N/A
11	Home Sensor Mount Shim	11126	1
12	Home Sensor Mount	11125	1
13	SS Socket Head Cap Screw, 2-56 x 0.375 in.	13145	10
14	SS Dowel Pin, 0.125 x 0.375 in.	13135	10
15	Work Post	N/A	N/A
16	Drive Gear	11315	1
17	Retaining Washer	11128	1
18	SS Button Head Cap Screw, 4-40 x 0.250 in.	13167	10
19	Purge Bayonet	B-BN4-K62	1
20	Threaded Insert	N/A	N/A
21	SS Socket Head Cap Screw, 4-40 x 0.500 in.	13163	10
22	Work Plate	11060	1
23	SS #6 Internal Tooth Lock Washer	13251	10
24	Power Strap	11117	1
25	Brush Spring	21007	10
26	Brush	11305	1
27	Power Post	N/A	N/A
28	SS Dowel Pin, 0.093 x 0.125 in.	13133	10
29	Drive Coupler	N/A	N/A
30	Drive Coupler Pin	N/A	N/A
31	Drive Coupler Pin Sleeve	N/A	N/A
32	SS Socket Head Cap Screw, 6-32 x 0.250 in.	13174	10
33	SS Socket Head Cap Screw, 2-56 x 0.187 in.	13111	10
34	Wire Ring Terminal	N/A	N/A
35	Brass Slotted Head Screw, 4-40 x 0.250 in.	21066	10

For part ordering information, contact your Swagelok representative.

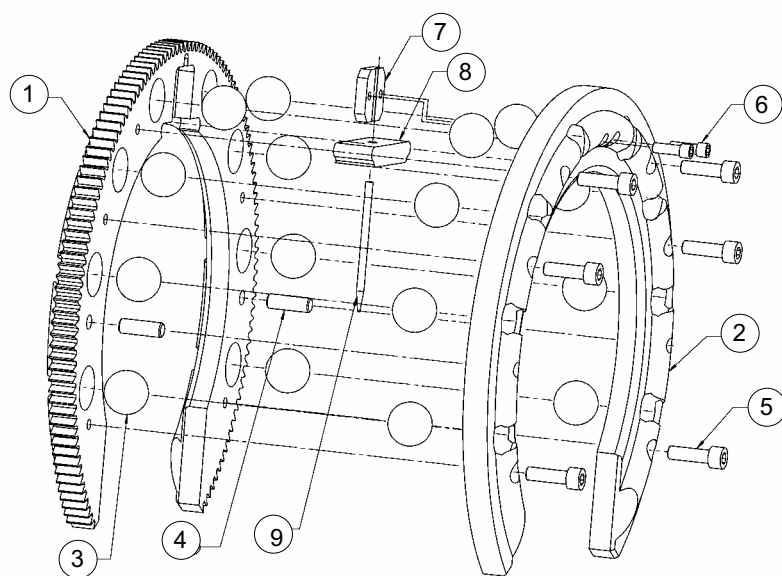


Figure 39 SWS-20H-C Rotor Assembly

*Table 12 SWS-20H-C Rotor Assembly Parts List*

<b>Reference No.</b>	<b>Description</b>	<b>Part No.</b>	<b>Minimum Order Quantity</b>
1	Rotor Gear Ring	21117	1
2	Rotor Brush Ring	21116	1
3	SS Ball Bearing, 0.375 in.	21123	10
4	Dowel Pin	N/A	N/A
5	SS Socket Head Cap Screw, 4-40 x 0.375 in.	13114	10
6	SS Socket Head Cap Screw, 2-56 x 0.250 in.	13176	10
7	Electrode Clamping Plate	11306	1
8	Ceramic Insert	11210	1
9	See Electrode Chart	N/A	N/A

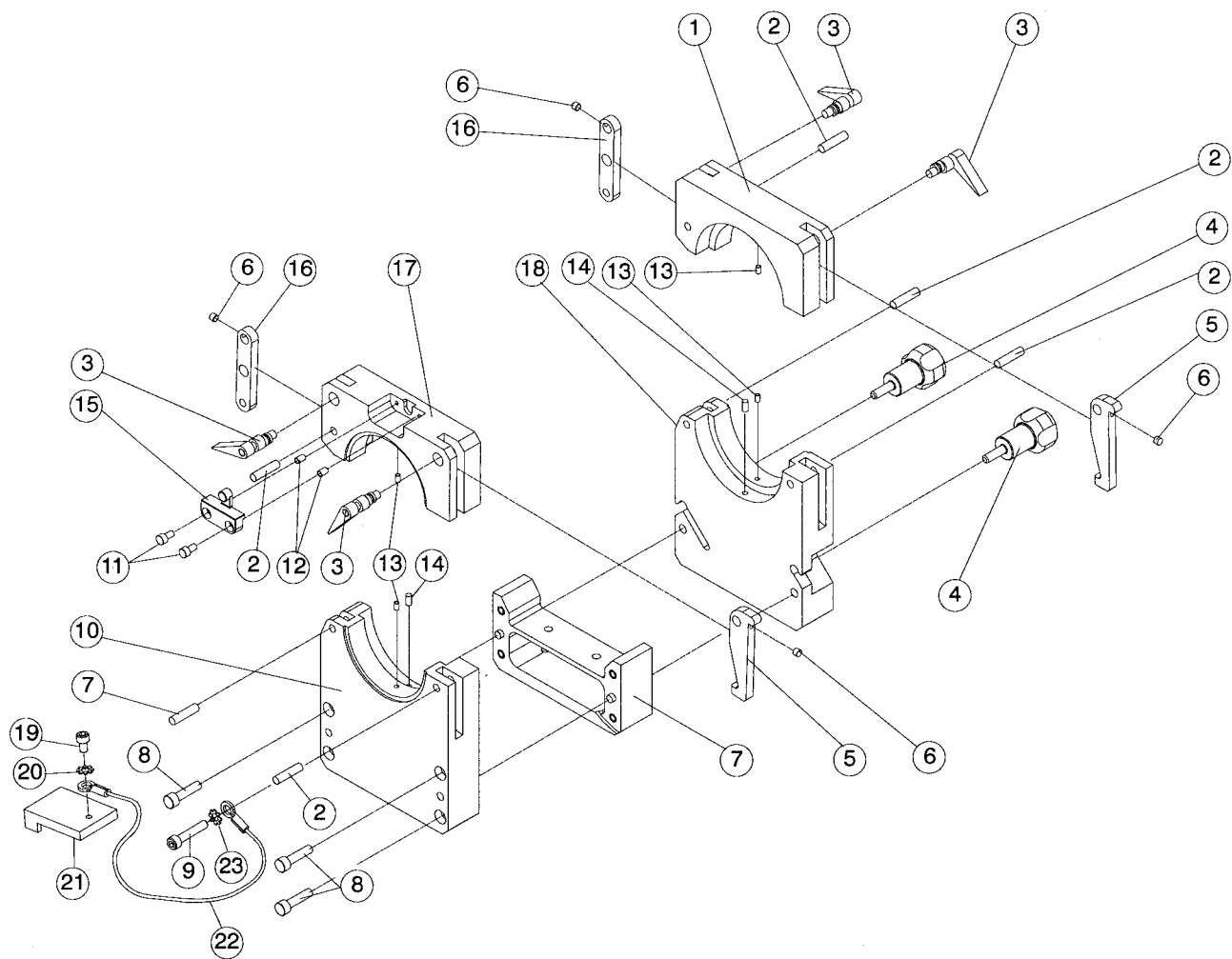


Figure 40 SWS-20TFB-A Tube Fixture Block

Table 13 SWS-20TFB-A Tube Fixture Block Parts List

Reference No.	Description	Part No.	Minimum Order Quantity
1	Side Plate Assembly (right)	SWS-20TSPR-A	1
2	Dowel Pin	N/A	N/A
3	Lever Cam Assembly	12308-1	1
4	Knob	12316	1
5	Latch	12307	1
6	SS Set Screw, 6-32 x 0.156 in., modified	12306	10
7	Plenum Assembly	SWS-20BPLEN	1
8	SS Socket Head Cap Screw, 10-24 x 1.000 in.	13184	10
9	SS Socket Head Cap Screw, 10-24 x 1.250 in.	13175	10
10	Side Plate Assembly (left)	SWS-20TSPL-A	1
11	SS Flat Head Screw, 6-32 x 0.313 in.	13318	10
12	Threaded Insert	N/A	N/A
13	Threaded Insert	N/A	N/A
14	Dowel Pin	N/A	N/A
15	Locking Tab	12360	1
16	Hinge	N/A	N/A
17	Side Plate Assembly (left)	SWS-20TSPL-A	1
18	Side Plate Assembly (right)	SWS-TSPR-A	1
19	SS Socket Head Cap Screw, 4-40 x 0.187 in.	13207	10
20	SS #4 External Star Washer	13171	10
21	Centering Gage	SWS-20CG-A	1
22	12 in. Lanyard	13231	1
23	SS #10 External Star Washer	13131	10

For part ordering information, contact your Swagelok representative.

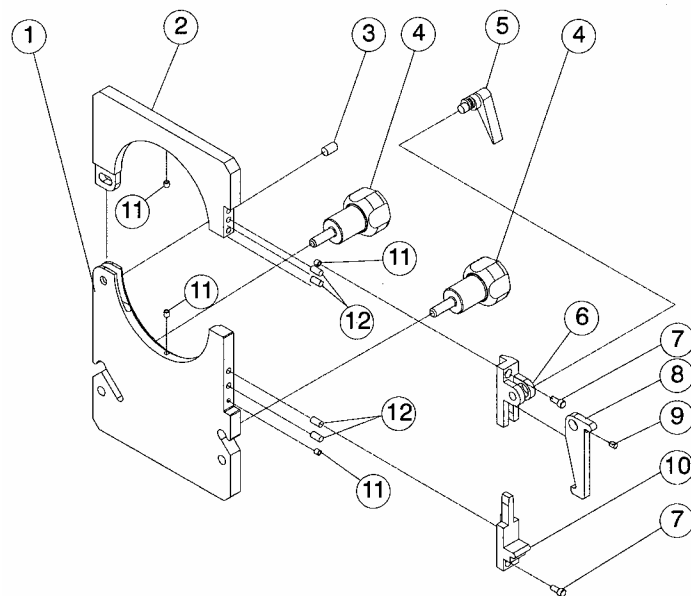


Figure 41 SWS-20FSP1R Special Purpose Side Plate



*Table 14 SWS-20FSP1R Special Purpose Side Plate Parts List*

<b>Reference No.</b>	<b>Description</b>	<b>Part No.</b>	<b>Minimum Order Quantity</b>
1	Thin Side Plate (right bottom)	N/A	N/A
2	Thin Side Plate (right top)	N/A	N/A
3	Dowel Pin	N/A	N/A
4	Knob	12316	1
5	Lever Cam Assembly	12130-2	1
6	Latch Holder (right top)	12317	1
7	SS Socket Head Cap Screw, 4-40 x 0.250 in.	13112	10
8	Latch	12146	1
9	SS Set Screw, 4-40 x 0.125 in.	12132	10
10	Latch Holder (right bottom)	12314	1
11	Threaded Insert	N/A	N/A
12	Dowel Pin	N/A	N/A

For part ordering information, contact your Swagelok representative.

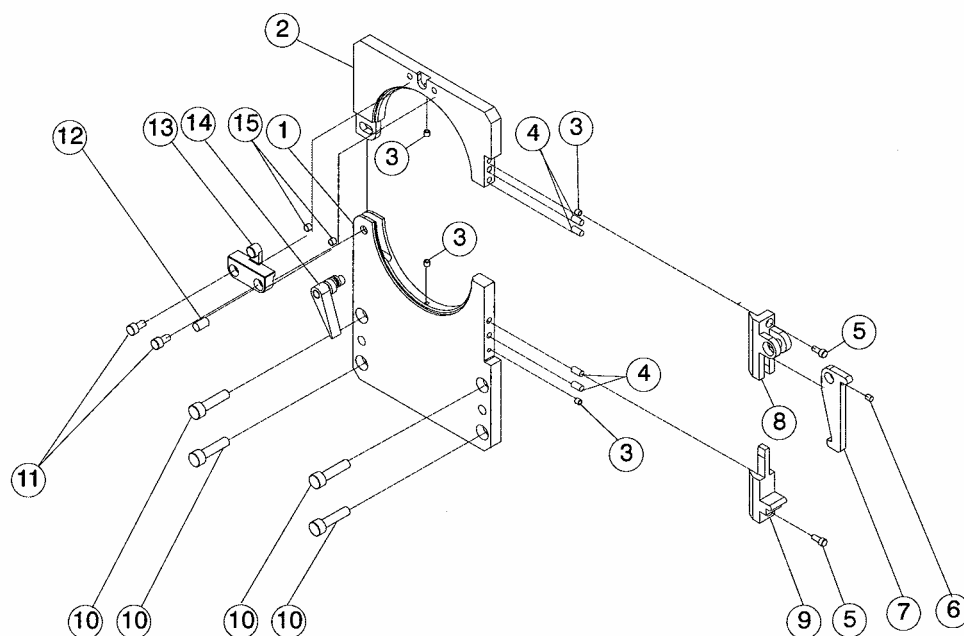


Figure 42 SWS-20FSP1L Special Purpose Side Plate

*Table 15 SWS-20FSP1L Special Purpose Side Plate Parts List*

<b>Reference No.</b>	<b>Description</b>	<b>Part No.</b>	<b>Minimum Order Quantity</b>
1	Thin Side Plate (left bottom)	N/A	N/A
2	Thin Side Plate (left top)	N/A	N/A
3	Threaded Insert	N/A	N/A
4	Dowel Pin	N/A	N/A
5	SS Socket Head Cap Screw, 4-40 x 0.250 in.	13112	10
6	SS Set Screw, 4-40 x 0.125 in.	12132	10
7	Latch	12146	1
8	Latch Holder (left top)	12313	1
9	Latch Holder (left bottom)	12315	1
10	SS Socket Head Cap Screw, 10-24 x 0.625 in.	13118	10
11	SS Flat Head Screw, 6-32 x 0.313 in.	13318	10
12	Dowel Pin	N/A	N/A
13	Locking Tab	12360	1
14	Lever Cam Assembly	12130-2	1
15	Threaded Insert	N/A	N/A

For part ordering information, contact your Swagelok representative.





